

CLAIMS

What is claimed is:

1. Method of removably connecting an electronic component to a circuit board, said circuit board having a plurality of contact areas on a surface thereof, said electronic component having a plurality of terminals on a surface thereof, comprising:

disposing a support substrate between the electronic component and the circuit board, the support substrate having a top surface and a bottom surface opposite the top surface;

mounting a plurality of resilient contact structures to the top surface of the support substrate;

mounting a plurality of contact structures to the bottom surface of the support substrate;

mounting the support substrate to the circuit board so as to make permanent electrical connections between the contact structures and the contact areas;

urging the electronic component against the resilient contact structures so that removable connections are made between the plurality of terminals and the resilient contact structures; and

within the support substrate, interconnecting selected ones of the resilient contact structures with selected ones of the contact structures.

2. Method, according to claim 1, further comprising:
fabricating the resilient contact structures as composite interconnection elements.

3. Method, according to claim 1, further comprising:
forming the contact structures as solder balls.

4. Method, according to claim 1, further comprising:
soldering the contact structures to the contact areas

5. Method, according to claim 1, wherein:
the electronic component is selected from the group
5 consisting of LGA-type semiconductor package, BGA-type
semiconductor package and bare semiconductor die.

6. Method, according to claim 1, wherein:
each of the resilient contact structures has a tip;
and
10 the terminals are urged against the tips of the
resilient contact structures in a direction which is generally
normal to the top surface of the support substrate.

7. Method, according to claim 1, wherein:
each of the resilient contact structures has a tip;
15 and
when the terminals are urged against the tips of the
resilient contact structures in a first direction which is
generally normal to the top surface of the support substrate,
the tips deflect in the first direction to effect a pressure
20 connection between the tips and the terminals and move in a
second direction which is generally parallel to the top surface
of the support substrate so as to wipe across the pads.

8. Method, according to claim 1, wherein:
each of the resilient contact structures has a tip;
25 and
the terminals are urged against tips of the resilient
contact structures in a direction which is generally parallel
to the top surface of the support substrate.

9. Solder-down socket, comprising:
a support substrate;
a plurality of resilient contact structures extending
upward from a top surface of the support substrate; and
5 a plurality of solderable raised contact structures
disposed on a bottom surface of the substrate, said solderable
raised contact structures being electrically connected to the
resilient contact structures.

10. Socket, according to claim 9, further comprising:
10 means for urging an electronic component against tips
of the resilient contact structures.

11. Socket, according to claim 10, wherein:
the electronic component is selected from the group
consisting of LGA-type semiconductor package, BGA-type
15 semiconductor package and bare semiconductor die.

12. Socket, according to claim 9, wherein:
the resilient contact structures are mounted to the
top surface of the support substrate.

13. Socket, according to claim 9, wherein:
20 end portions of the resilient contact structures
extend at least into the support substrate.

14. Socket, according to claim 13, wherein:
the end portions of the resilient contact structures
extend through the support substrate.

25 15. Socket, according to claim 13, wherein:
the solderable raised contact structures are directly
connected to ends of the resilient contact structures.

16. Socket, according to claim 13, further comprising:

a plurality of plated through holes extending through the support substrate;

wherein:

the end portions of the resilient contact structures extend into the plated through holes.

17. Socket for releasably connecting an electronic component to a circuit board, comprising:

resilient contact structures extending upward from a top surface of a support substrate

contact structures disposed on a bottom surface of the support substrate and connected through the support substrate to the resilient contact structures.

18. Socket, according to claim 17, wherein:

the resilient contact structures are composite interconnection elements

19. Socket, according to claim 17, further comprising:

a frame element disposed around a peripheral edge of the support substrate.

20. Socket, according to claim 19, further comprising:

means for aligning the frame element in a prescribed positional relationship to the circuit board.

21. Socket, according to claim 20, wherein the means for aligning includes pins extending from the frame element and corresponding holes in the circuit board.

22. Socket, according to claim 17, wherein:

the resilient contact structures are formed as cantilever beams.

23. Socket, according to claim 17, wherein:
the contact structures are solder balls.

24. Socket, according to claim 17, wherein:
each of the resilient contact structures has a tip;

5 and

further comprising:

a stiffener element disposed above the support
substrate having holes through which the tips of the resilient
contact structures extend.

10 25. Socket, according to claim 17, further comprising:
means for urging the electronic component down onto
the tips of the resilient contact structures.

15 26. Socket, according to claim 25, wherein the means for
urging includes a spring clip which extends across a top surface
of the frame element.

20 27. Socket, according to claim 17, further comprising:
means for receiving the electronic component on an
upper surface thereof, and for permitting the resilient contact
structures to make pressure contact with the external connection
points of the electronic component, said means for receiving
the electronic component having a lower surface opposing the
top surface of the support substrate.

28. Socket, according to claim 27, wherein the means for
receiving the electronic component is a planar element.

25 29. Socket, according to claim 28, further comprising:
a plurality of holes extending through the planar
element, from the upper surface to the lower surface thereof.

30. Socket, according to claim 29, wherein:
said holes are tapered and have a smaller dimension
at the upper surface of the planar element and a larger
dimension at the lower surface of the planar element.

5 31. Socket, according to claim 28, further comprising:
 means for moving the planar element in a direction
parallel to the top surface of the support substrate to provide
an effective pressure contact between the external connection
points and the resilient contact structures.

10 32. Socket, according to claim 17, further comprising:
 a frame element disposed around the support substrate;
 a planar element disposed above the support substrate,
and having at least one hole permitting the tips of the
resilient contact structures to pass through the planar element;
15 a cam lever extending from a cavity in the frame
element; and
 an offset portion of the cam lever extending through
a hole in the planar element.

20 33. Socket, according to claim 32, further comprising:
 at least one recess on an inner surface of the frame
element, slidably receiving the planar element.

 34. Socket, according to claim 32, wherein:
 the resilient contact structures are composite
interconnection elements.

25 35. Socket, according to claim 32, wherein:
 the contact structures are solder balls.

 36. Socket, according to claim 28, further comprising:
 means disposed on the upper surface of the planar
element for retaining the electronic component.

37. Socket, according to claim 36, wherein:
the means for retaining is at least three pawls
extending upward from the upper surface of the planar element.

38. Socket, according to claim 17, wherein:
5 the electronic component is selected from the group
consisting of LGA-type semiconductor package, BGA-type
semiconductor package and bare semiconductor die.

39. Solder-down socket, for making pressure connections
to terminals of an electronic component, comprising:

10 a support substrate having a top surface and a bottom
surface;

a plurality of resilient contact structures extending
from the top surface of the support substrate, each resilient
contact structure having a tip at a free end thereof; and

15 means for effecting a pressure connection between the
tips of the resilient contact structures and the terminals of
the electronic component.

40. Solder-down socket, according to claim 39, further
comprising:

20 a plurality of solderable raised contact structure
disposed on the bottom surface of the support substrate and
connected via the support substrate to the plurality of
resilient contact structures.

41. Solder-down socket, according to claim 39, wherein:

25 the means for effecting a pressure connection moves
the terminals of the electronic component against the tips of
the resilient contact structures.

42. Solder-down socket, according to claim 39, wherein:
the means for effecting a pressure connection moves
the tips of the resilient contact structures against the
terminals of the electronic component.

5 43. Solder-down socket, according to claim 39, further
comprising:

means for limiting wiping of the tips of the resilient
contact structures across the terminals of the electronic
component.

10 44. Solder-down socket, according to claim 39, wherein:
the electronic component is a bare semiconductor die.

45. Solder-down socket, comprising:

a support substrate having a plurality of holes
extending therethrough;

15 a plurality of pre-fabricated resilient contact
structures, each having a base portion and a tip;

the resilient contact structures being supported
within the holes in a prescribed spatial relationship with one
another by the support substrate; and

20 a solderable raised contact structure disposed on the
base portion of each resilient contact structure.

46. Solder-down socket, according to claim 45, wherein:
the resilient contact structures are composite
interconnection elements.

25 47. Solder-down socket, comprising:

a support substrate having a top surface, a bottom
surface and a plurality of holes extending therethrough;

30 a plurality of metallic pads, each pad having a top
surface and a bottom surface, each pad disposed on the bottom
surface of the support substrate in alignment with a hole;

a plurality of pre-fabricated resilient contact structures, each having a base portion and a tip;

the base portions of the resilient contact structures being supported in a prescribed spatial relationship with one another by the top surfaces of the metallic pads; and

a solderable raised contact structure disposed on the bottom surface of each metallic pad.

48. Solder-down socket, according to claim 47, wherein:

the resilient contact structures are composite interconnection elements.

49. Interconnection structure for making contact to first terminals of an electronic component, comprising:

a support substrate having a top surface and second terminals disposed on the top surface of the substrate; and

a plurality of resilient contact structures extending generally parallel to one another from each second terminal, the resilient contact structures extending from each second terminal acting in concert with one another to make a pressure connection to a selected one of the first terminals of the electronic component.

50. Interconnection structure, according to claim 49, wherein:

each resilient contact structure has a tip; and

the tips are oriented to make pressure contact with the first terminals of the electronic component with a contact force that is principally generally normal to the top surface of the support substrate.

51. Interconnection structure, according to claim 49, wherein:

each resilient contact structure has a tip; and

the tips are oriented to make pressure contact with

the first terminals of the electronic component with a contact force that is generally parallel to the top surface of the support substrate.

52. Interconnection element for making contact to terminals of an electronic component, comprising:

a support substrate having a top surface; and

a plurality of resilient contact structures extending from the top surface of the support substrate, each resilient contact structure having two ends, both ends of each resilient contact structure being attached to the support substrate, a midportion of each resilient contact structure shaped to receive a one of the terminals of the electronic component by pressure contact therewith in a direction which is generally parallel to the top surface of the support substrate.

53. Interconnection element, according to claim 52, wherein:

the electronic component is selected from the group consisting of LGA-type semiconductor package, BGA-type semiconductor package and bare semiconductor die.

54. Interconnection element for making contact to terminals of an electronic component, comprising:

a support substrate having a top surface; and

a plurality of resilient contact structures extending from the top surface of the support substrate, each resilient contact structure having a one end attached to the support substrate and an other end extending above the support substrate, an end portion at the other end of the resilient contact structure shaped in an arcuate manner to receive a terminal of the electronic component by pressure contact therewith in a direction which is generally normal to the top surface of the support substrate.

55. Interconnection element, according to claim 54,
wherein:

the electronic component is selected from the group
consisting of LGA-type semiconductor package, BGA-type
5 semiconductor package and bare semiconductor die.

56. Solder-down socket, comprising:

a circuit board substrate having a plurality of plated
through holes extending through the substrate from a top surface
to a bottom surface thereof, each through hole having a top
10 contact area exposed on the top surface of the substrate and a
bottom contact area exposed on the bottom surface of the
substrate;

a plurality of resilient contact structures mounted
to the top contact areas and extending from the top surface of
15 the substrate; and

a plurality of solder balls mounted to the bottom
contact areas of the plated through holes.

57. Solder-down socket, comprising:

a support substrate having a plurality of plated through holes extending through the substrate from a top surface to a bottom surface thereof, each through hole having a bottom contact area exposed on the bottom surface of the substrate;

a plurality of resilient contact structures mounted into the plated through holes and extending from the top surface of the substrate; and

a plurality of solder balls mounted to the bottom contact areas of the plated through holes.

58. Solder-down socket, comprising:

a support substrate having a plurality of holes extending through the substrate from a top surface to a bottom surface thereof;

a plurality of resilient contact structures having bottom ends mounted in the holes and top ends extending from the top surface of the substrate; and

a plurality of solder balls mounted to the bottom ends of the resilient contact structures.

59. Solder-down socket, according to claim 58, wherein:

the bottom ends of the resilient contact structures extend completely through the holes, end portions thereof being exposed beneath the bottom surface of the support substrate; and

the solder balls are mounted to the end portions of the resilient contact structures

60. Solder-down socket, comprising:

a support substrate having a top surface and a bottom surface;

a plurality of compliant contact structures extending from the top surface of the support substrate; and

a plurality of solder balls mounted to the bottom surface of the support substrate and connected to the compliant

contact structures.

61. Surface-mount socket, comprising:

a support substrate having a top surface and a bottom surface;

5 a plurality of compliant contact structures extending from the top surface of the support substrate; and

a plurality of solder balls mounted to the bottom surface of the support substrate and connected to the compliant contact structures.